Hatfield Model release 3.1

Calculation of Switching Investment (cont'd)

Large LEC Switching Investment

$$y = -14.922Ln(x) + 242.73$$
$$R^2 = 0.9608$$

Investment / Line (y-axis): $160, $140, $120, $100, $80, $60, $40, $20, $-

Lines / Switch (x-axis): 0, 10,000, 20,000, 30,000, 40,000, 50,000, 60,000, 70,000, 80,000
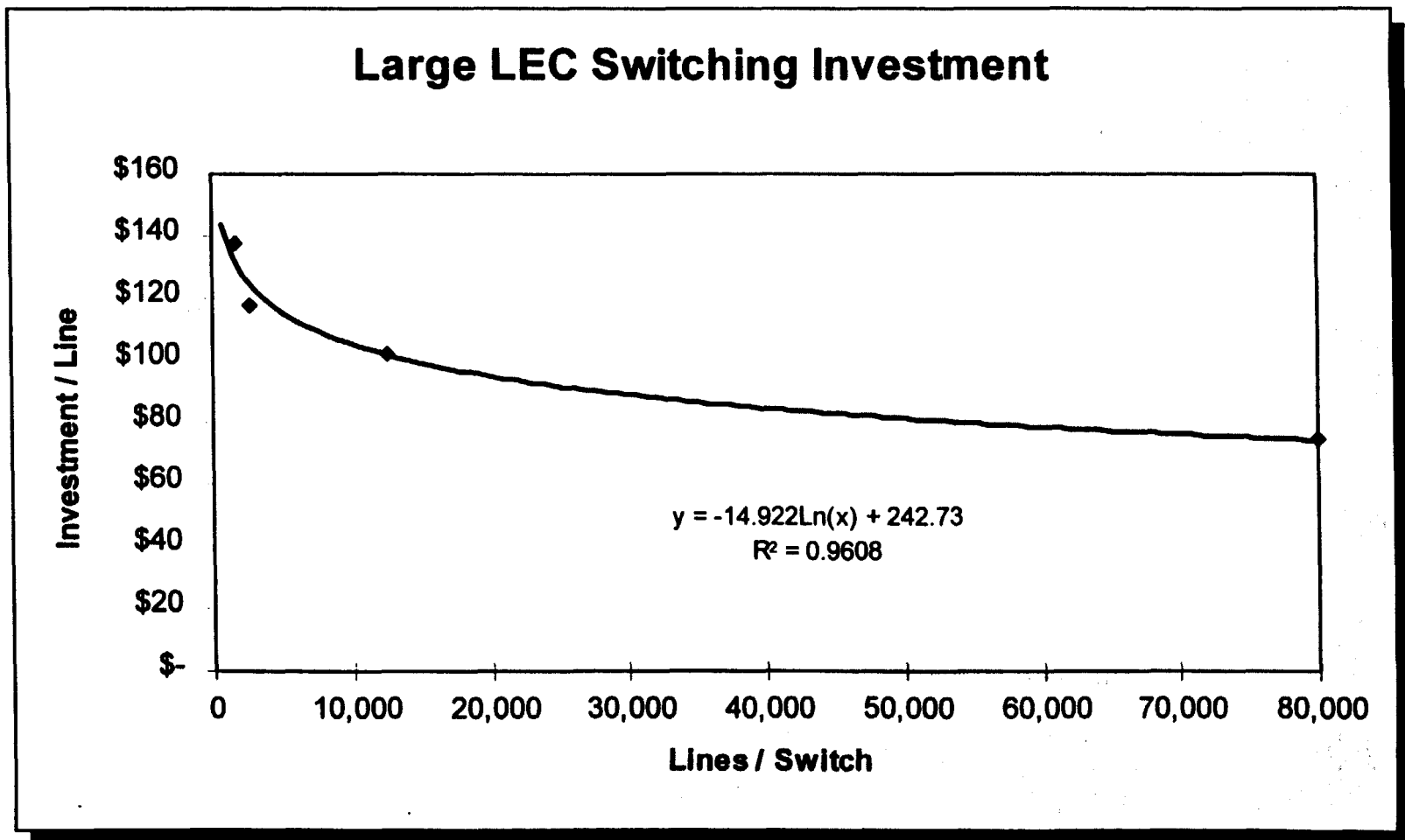
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Calculation of Monthly Costs

- Results displayed by density zone, wire center, or CBG
- Input of depreciation lives by standard plant category
- Depreciation calculations reflect mid-year investment, net salvage value, exclusion of land
- Inclusion of investment for motor vehicles, buildings, and garage/other work equipment

Hatfield Model release 3.1

Calculation of Monthly Costs (cont'd)

- Separate costs for DLC and non-DLC loops
- Three types of interoffice transport modeled
  - IXC dedicated transport
  - Common (tandem-switched) transport
  - Direct (end office to end office) transport

Hatfield Model release 3.1

Universal Service Calculations

● More options for determining level of USF
support

- include/exclude cost of switched access

- specify percent of loop cost to include in
calculation

- calculate USF costs for single-line business
lines

Hatfield Model release 3.1

Model Operation

- Model operates much more quickly
  - ~10 minutes for most states
- Reduced PC requirements
  - Most states (exc. CA, TX) will run on a "normal" desktop PC
  - Model requires Windows '95 or Windows NT4, MS-Excel 7.0
- Model executes as a standard PC program, and installs on disk using a standard Windows installer program

Hatfield Model release 3.1

Model Operation

- Model contains data on all states, all telephone companies
  - This information stored in a database that is installed with the model components
- Model may be run for individual companies, or for all non-RBOCs at once

Hatfield Model release 3.1

Summary

The Hatfield Model release 3.1:

- Reliably and consistently estimates the forward-looking economic cost of:
  - unbundled network elements
  - interexchange access
  - interconnection
  - basic local telephone service
- Adheres to federal and state TELRIC principles
- Significantly refines and increases the certainty of results it produces

Hatfield Model, Release 3

Forward-Looking Economic Costs of
Universal Service, Carrier Access and
Unbundled Network Elements

Model Developed by	Universal Service Joint Board
Hatfield Associates	Washington, D.C.
for AT&T and MCI	February 1997

Presentation overview

- What is the Hatfield Model?
- What network elements does it model?
- How does the Hatfield Model work to calculate forward-looking economic costs?
- Comparison of Hatfield Model with other proxy cost models
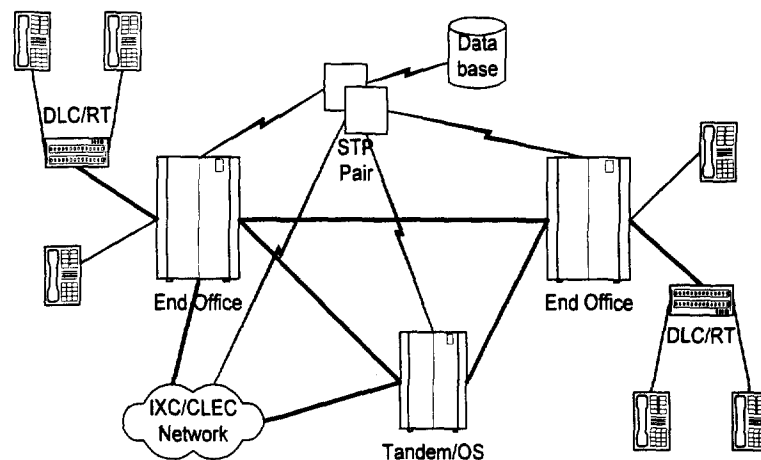
What is the Hatfield Model?

■ A model of a reconstructed local exchange network that assumes:

➤ Modern technology will be employed in efficient network configurations

➤ Wire centers will remain in their current locations

➤ All narrowband demand in area will be served

➤ Carrier will operate using efficient practices

■ The cost of such a network would equal that incurred by an efficient competitor

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Complete Local Network Modeled

DLC/RT

Data base

STP Pair

End Office

End Office

DLC/RT

IXC/CLEC Network

Tandem/OS

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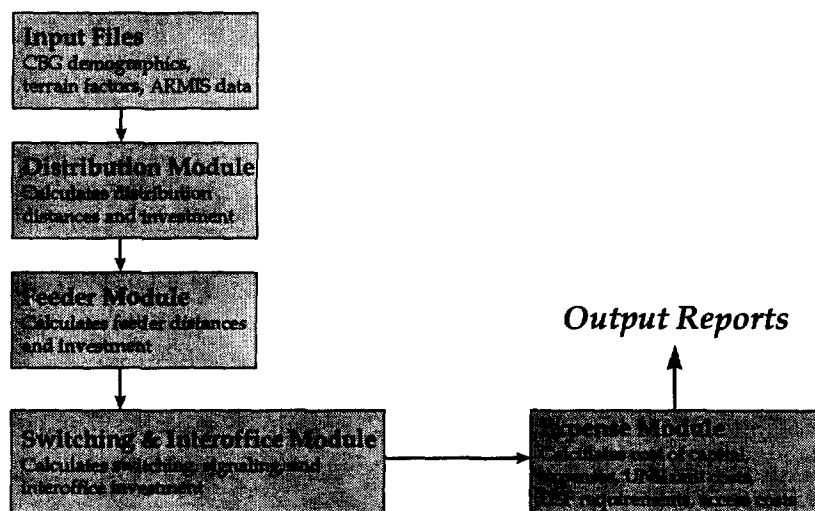
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What does Hatfield calculate?

- Cost of unbundled network elements
  - Loop (NID/Dist'n/DLC/Feeder) by density zone
  - Local/tandem switching
  - Interoffice transport
  - Signaling systems and databases
  - Operations support systems
  - Operator systems and public phone services
- Cost of universal service by density zone
- Cost of carrier access and other interconnection services

AT&T 4/14/97 5

Release 3 flowchart

Input Files
CBG demographics,
terrain factors, ARMIS data

Distribution Module
Calculates distribution
distances and investment

Feeder Module
Calculates feeder distances
and investment

Switching & Interoffice Module
Calculates switching, signaling, and
interoffice investment

Output Reports

AT&T 4/14/97 6

4/14/97

3

3

Input Data

- Determination of lines/minutes/call attempts demand quantities in each CBG
  - Residence / Business / Public / Special
- PNR/Donnelly/Claritas/U.S. Census determination of residential first and "second" lines
  - Using age and income demographics
- PNR/Dun & Bradstreet determination of business lines
  - Using employees and SIC telephone intensity

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Input Data

- PNR assignment of CBGs to serving wire centers
  - Based on mode wire center as determined by Donnelly list of geo-coded NPA-NXXs
- Traffic quantities
  - From ARMIS
- User-adjustable inputs
  - National default values pre-entered
  - Integrity of the model depends on the reasonableness of these parameter values

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Loop Investments

- Distribution cable quantities calculated to ensure all demand is served
  - Empty CBGs and empty area within CBGs
  - Grid / clustering patterns
  - High-rise patterns
  - Extension of feeder into CBG quadrants
- Engineering of longer distribution loops
  - Ensures high quality voice and data transmission performance
  - Is economical for universal service

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Loop Investments

- Feeder is either copper or fiber
  - Based on user-adjustable crossover point
  - Default is 9000 feet
- Fiber feeder is used to carry modern Integrated Digital Loop Carrier (IDLC)
  - Bellcore TR-303 compliant
  - 100% redundant

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Switching Investments

- Logarithmic switching investment curve
  - Large LECs (larger vendor discounts)
  - Small LECs (smaller vendor discounts)
- Switches sized to serve specific demands placed on them
  - Lines / minutes / call attempts / holding time
  - Engineered with required administrative underfill

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Interoffice Investments

- Trunking is over a combination of SONET fiber rings and point-to-point facilities
- Costs calculated for:
  - Dedicated access (including entrance facilities)
  - Common (EO-Tandem) transport
  - Direct (EO-EO) transport
- SS7 signaling network including:
  - Signaling links
  - Signal Transfer Points (STPs)
  - Databases / Service Control Points (SCPs)

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Expenses

- Depreciation
  - Calculated for 23 separate plant categories
  - Based on approved economic projection lives adjusted for net salvage value
- Cost of capital calculations based on midyear net investments
- Income tax gross-ups on equity returns
- Fully adjustable returns to debt and equity and D/E ratio

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Expenses

- Forward-looking operating expenses disaggregated across multiple categories based on:
  - Amount of investment supported
  - Number of lines served
- Corporate overheads
  - Computed explicitly for General Support Facilities
  - Additionally added as a percentage of direct costs
- Regional labor cost adjustments possible

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Output Reporting

- By nine lines density zones
  - Further disaggregated by DLC/nonDLC lines
- By wire center
- By individual CBG
- Costs disaggregated by:
  - USF cost elements (loop, switch, transport, signaling, retail) with user-adjustable definition of supported basic service)
  - Fifteen unbundled network elements
  - Carrier access and interconnection

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How Hatfield Builds Costs

- Determines customer demand
  - By geographical location, customer and service type
- Calculates efficient facilities investment required to serve demand
  - Materials / placement / installation
- Calculates capital carrying cost
  - Depreciation / return / taxes
- Adds network operations and support expenses
- Adds share of corporate overheads
- Adds sales/retail expense as appropriate

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Running the Hatfield Release 3

- Basic model is written in Microsoft Excel
- Interface is Visual Basic
- Access database used to store data and scenarios
- All data and calculations are visible and auditable -- nothing locked
- Runs much quicker than v.2.2.2
- Can run on a typical desktop PC

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Comparison With Other Models

Hatfield R3	BCPM
■ Combination of copper and DLC on fiber loop plant	■ Combination of copper and DLC on fiber loop plant
■ Digital end office and tandem switching	■ Digital end office switching, no tandems
■ SONET ring and point-to-point fiber interoffice transport	■ No interoffice transport modeled
■ SS7 signaling	■ No signaling modeled
■ Public and operator	■ No public phone or operator services

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Comparison With Other Models

Hatfield R3

- Accurate count of res/bus lines by CBG
- Assignment of CBGs to wire center based on actual NPA-NXXs
- Usage (DEMs / call attempts) modeled

BCPM

- Imprecise count of res/bus lines by CBG
- Assignment of CBGs to wire center based on geographic centroid
- Usage not modeled

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Comparison With Other Models

Hatfield R3

- Investments in entire network (loop, switching, transport, signaling, etc.) built explicitly
- Explicit calculation of monthly costs for 15 UNEs, disaggregated basic/universal service, and carrier access and interconnection

BCPM

- Loop and and partial switching investment built explicitly
- Explicit calculation of monthly costs for aggregated basic/ universal service

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Comparison With Other Models

Hatfield R3	BCPM
■ Outputs reported at density zone, wire center or CBG level	■ Outputs at density zone, wire center or CBG level
■ Analysis is auditable	■ Analysis is unauditable
➤ Calculations open	➤ Calculations black box
➤ Input data public	➤ Input data proprietary
➤ Outputs disaggregated	➤ Outputs aggregated
■ Results specific to state, and COSA for USF, UNEs, and access	■ General results for USF

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Summary

■ The Hatfield Model calculates accurately the efficient forward-looking cost of both Universal Service and Unbundled Network Elements

■ The Hatfield Model permits flexible analyses using data and input values that are are specific to the state/geography studied, e.g.,

➤ Rate of return

➤ Depreciation

■ Output information is granular and exhaustive

AT&T   4/14/97   22